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550 feet above the water surface of the river. The storage capacity of the reservoir to be created by such a dam would be in excess of 25,000,000 acre feet. The discharge of Colorado River at this point may be noted, in approximate figures, as ranging from 7,000,000 to 22,000,000 acre feet per year. The mean annual discharge may be about 15,000,000 acre feet. The surface area of the reservoir would reach 125,000 acres.

The feasibility of a dam of the dimensions proposed seems now to be generally accepted by the engineers who have investigated the dam site. A reservoir at Boulder Canyon would control the flow of Colorado River except the contributions by the Gila River, and the storage could be so manipulated that it would eliminate the lower river flood menace to the extent that this menace is due to up river high stages. Such a reservoir would also regulate the flow of the river for irrigation purposes, thereby permitting the extension of the irrigated area, and would generate upward of 600,000 horse power for electrical transmission.

It is not enough to know that this reservoir should be constructed. Equally important is the matter of urgency. And this applies with equal force to the reservoir control of the river and to the placing of the lower river upon a direct course to the Gulf.

C. E. GRUNSKY

### PROGRESS IN POLYNESIAN RESEARCH

IN view of the many inquiries regarding the status of the anthropological studies in Polynesia, undertaken by the Bishop Museum, a summary statement of progress and results appears to be appropriate.

Systematic investigations of the origin and culture of the Polynesian peoples have been conducted by the Bayard Dominick Expedition and made possible by a generous gift of Bayard Dominick, Jr., of New York—funds given to Yale University and placed by the university at the disposal of Bishop Museum. During the summer of 1920 four field parties began their work—the first in Tonga, the second in the Marquesas, the third in Rurutu, Raivavai, Tubuai and Rapa of the Austral Islands, the

fourth in selected islands of the Hawaiian group. Through cooperative arrangements with scientists of New Zealand, physical measurements of the Maori and a complete survey of the Maori of Chatham Islands forms part of the program. By the end of this year all the field parties will have returned to Honolulu. These surveys supplemented by investigations in Tahiti and adjacent islands organized for 1923, will complete the present plans of the Bayard Dominick Expedition. Contributions to the physical anthropology of Samoa and of Tonga have been published by the museum; other papers are in press or in preparation for publication.

The prosecution of this search for Polynesian origins aims at the solution of two distinct problems: (1) the source of the physical racial characteristics, which have combined to make the Polynesian physical types; and (2) the source of the original elements which formed the basis of the ancient culture of the people. Dependent upon the solution of these is a third problem: the degree in which racial and cultural transplantation and stratification are correlated.

Dr. Louis R. Sullivan, physical anthropologist of the American Museum of Natural History, is devoting himself to the study of the racial data secured by himself and by other members of the expedition. He makes the following tentative classification of the physical characters which go to make up the two basic elements in the Polynesian peoples:

Type 1 is characterized by (1) tall stature, (2) moderately long heads, (3) relatively high, narrow faces, (4) relatively high, narrow noses, (5) straight or wavy black hair of medium texture, (6) well-developed moustache and moderate beard on the chin, (7) moderate amount of hair on the body and limbs, (8) light brown skin, (9) incisor rim present occasionally, (10) femur flattened (platymeric), (11) tibia flattened (platymeric), (12) ulna flattened (platolentic), (13) lips above average in thickness. Type I is the so-called *Caucasoid* element in Polynesia; sometimes spoken of as *Pseudo-Caucasian* or *Pseudo-Mediterranean*. Macmillan Brown regards it as *Nordic*. In its characteristics it is intermediate between some

Caucasians and some Mongols. It may eventually prove to be a very primitive Caucasoid type, probably related to primitive inhabitants of Micronesia, Indonesia, and to the Aino and some of the primitive American Indians. It is probably the oldest type in Polynesia (except where it was possibly preceded by the Melanesians), and it occupied all of the Polynesian Islands. At present it seems to be strongest in the southern part of Polynesia.

Type II is characterized by (1) shorter stature, (2) shorter heads, (3) low, broad faces, (4) low, broad noses, (5) wavier hair, (6) undeveloped beard, (7) body hair rare except on the legs, (8) darker brown skin, (9) incisor rim rare, (10), (11), (12) long bones less flattened (data meager, results inferred), (13) lips well above the average in thickness. Type II is the element so often referred to as Malay, and is undoubtedly the one which has been traced to the region of the Celebes by linguists and ethnologists. Malay is not a suitable name for it, since it is usually restricted to groups more definitely Mongoloid. It approaches somewhat closely Giuffrida-Ruggeri's Indonesian type. This element has contributed some of the negroid characteristics (full lips, dark skin, broad flat noses), usually attributed to Melanesian mixture. The type is strongest in northern and central Polynesia.

Edward S. Handy, ethnologist of the Bishop Museum staff, and a member of the Dominick Expedition to Tahiti and the Marquesas in 1920-21, has come to the following conclusions with regard to the general ethnology of Polynesia.

There is a basic Polynesian cultural complex, some of the most important elements in which are: (1) cooking by means of heated stones in ground ovens; (2) the use of stone pestles for pounding food; (3) the use of wood, gourd, and cocoanut shell, rather than pottery, for containers; (4) skillful woodworking and carving; (5) tattooing; (6) the making of tapa, or bark cloth; (7) a characteristic relationship system; (8) the customs of adopting and betrothing children; (9) systematic agriculture and fishing, taro and potato cultures; (10) professional craftsmanship and leadership in industry; (11) tribal government of simple patriarchal communism; (12) preserv-

ing heads of enemies as trophies, and cannibalism; (13) ancestor worship, the preservation of genealogies, and the hiding of skeletal remains; (14) inspirational diviners; (15) a speculative creation mythology conceived on the principle of dualism, expressed in terms of male and female agencies. This complex was universally distributed throughout Polynesia; but it is most clearly to be distinguished in the historic cultures of New Zealand and the Marquesas, both of which groups may be characterized as outposts. These elements being universal, and best preserved in the marginal region, may be taken to represent the primitive, in the sense of original, Polynesian culture. This we may call Culture A.

Superimposed on this original culture are certain other elements, some of the most important of which are: (1) organized government; (2) a rigid social classification; (3) complicated systems of land division and ownership; (4) great sacredness of chiefs and elaborate etiquette; (5) organized dancing as a social and religious institution; (6) organized religious ceremonial and priesthood; (7) a generation cult and seasonal rites; (8) haruspication. As compared with Culture A, this culture appears to have been characterized by a higher social and religious, rather than higher technical, development. This group, with other associated elements, too numerous to include here, may be called Culture B.

It is possible that the elements in Culture B may have resulted by a natural evolution from the primitive Culture A. But it is far more probable that they represent the culture of a second immigrating wave of a people, closely related culturally to those of the first wave. Churchill's analysis of the language led him to the conclusion that the dialect spoken by the second wave of migrators to Tonga and Samoa was very closely related to that of the original settlers.

A study of Polynesian ethnology recently completed by Ralph Linton indicates that the material culture of the Marquesans and related groups support entirely the theory of an original culture and later overlay. The more important elements which his study adds to the classification given by Dr. Handy are: to Culture A, (1) a rectangular house with end

posts and bed-space; (2) a canoe made of five parts; and (3) the tanged adze; to Culture B, (1) the oval house; and (2) wooden head rests and utensils with legs.

It is interesting to note that the basal Polynesian physical type (Type I), as worked out by Sullivan, is universally distributed, but strongest in the south, and the original culture (Culture A), also universally distributed, is clearest in the south (New Zealand) and east (the Marquesas). Also physical Type II is strongest in north and central Polynesia, the same region in which elements in Culture B are dominant. This demonstrated parallelism of racial types and cultural stratification rests on conclusions arrived at independently by members of the museum staff working in widely separated fields with no opportunity for consultation. It is regarded as a very important contribution to the attack on the Polynesian problem. Another contribution is the definition of characteristics and elements belonging to the respective types and cultures—a prerequisite to comparative studies.

As regards the sources of these racial types and cultural elements and the routes by which they came to Polynesia, the evidence in hand indicates the region of the Malay archipelago (Indonesia) and southeast Asia as that from which the Polynesian ancestors commenced their eastward drift. Whither, beyond that region the search for ultimate origins may lead, can not be foreseen. The writing of the earliest chapters in the history of the Polynesians and of other Pacific races must await the definition of ancient and modern Asiatic types and cultures and the determination of early stages revealed through archeology.

The work of the archeologists of the Bayard Dominick Expeditions revealed no very ancient human habitation in the central and south Pacific. For the Polynesian settlement the evidence serves to substantiate the conclusions of William Churchill, based on linguistic and cultural study. The following dates are considered reasonable estimates: A.D. 0, the first Polynesian migratory movement; A.D. 600, a second migration; and A.D. 1000, a period of great Polynesian expansion. According to S. Percy Smith and other Maori scholars, New

Zealand was already in possession of original settlers by the tenth century although the main Maori migration did not occur until the thirteenth and fourteenth centuries. Dr. Handy has concluded that the Marquesas Islands were first settled in the tenth century or slightly earlier, and Fornander presents good reasons for the belief that the original settlers of Hawaii experienced the coming of a migratory wave at the beginning of the eleventh century.

At least three general routes of migration appear to have been used through Indonesia: (1) along the coasts of New Guinea, (2) through Micronesia, (3) through and along the marginal region east of Melanesia.

Two years of organized study has shown that the history of Polynesia is fundamentally a field problem and that progress depends upon the accumulation of facts by trained students.

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## SCIENTIFIC EVENTS

### A FOREST UNDER THE CITY OF WASHINGTON

EVIDENCE of the existence of an ancient swamp in which great trees flourished in days long past, possibly contemporaneous with earliest man in America, has been discovered in a deep excavation made for the foundation of a hotel under construction in Washington, D. C. At a depth of about twenty-five feet below the street level the excavation disclosed a layer of black swamp muck, containing large quantities of wood, tree trunks and stumps. Some of the stumps are of great size, a few of them reaching a diameter of nine or ten feet. Much of the wood is well preserved, showing clearly the woody structure and the external markings of the bark. A preliminary examination indicates that one of the more common trees of this ancient swamp was cypress.

The story of these trees, however, is only a brief chapter of the whole geologic history shown in the excavation, which has just been examined by Chester K. Wentworth for the